

Mr. G. T. Todd, April 24, 1906, before the Men's Guild of St. Paul's Church, Albany, N. Y., on "Meteorological Instruments, Weather Maps, and Forecasting".

Mr. F. J. Walz, April 5, 1906, before the Male High School, Louisville, Ky., also April 6, before the Female High School, on "The Forecast Work of the Weather Bureau", with lantern slide illustrations.

Classes from colleges, schools, academies, etc., have visited Weather Bureau offices, to study the instruments and equipment and receive informal instruction, as reported from the following offices:

Albany, N. Y., April 11, 1906, 35 men from the local Young Men's Christian Association.

Buffalo, N. Y., April 27, 1906, a physical geography class from the State Normal School.

Charlotte, N. C., April 28, 1906, the junior physics class from Elizabeth College.

Detroit, Mich., April 13, 1906, a class from the Leggett Home and Day School.

Evansville, Ind., April 9, 1906, a section of the senior class of the Henderson, Ky., High School.

Iola, Kans., April 3 and 6, 1906, a class in physical geography from the Iola High School, in two sections.

La Salle, Ill., during the middle of April, several visits by the class in general science of the La Salle-Peru Township High School.

Little Rock, Ark., April 2, 1906, the senior physics class of the local High School.

Moorhead, Minn., April 10 and 11, 1906, the physical geography class of the Normal School, in two sections.

Pittsburg, Pa., April 16 and 17, 1906, the class in physics of the Fifth Avenue High School, in sections.

Springfield, Ill., April 12, 1906, over 150 pupils of the local High School.

Syracuse, N. Y., April 5, 1906, a class from the local High School.

MR. R. F. deGRAIN.

Mr. Reinhold Frederick deGrain, clerk of class I in the Weather Bureau, died at his residence in Washington, D. C., on April 25, 1906. Mr. deGrain, born in Marien, Werder, Prussia, July 18, 1840, came to America in 1862, and at once entered the Union Army (the avowed purpose of his immigration), and was discharged after an honorable service of three years' duration. He joined the Signal Corps in 1874, and, with the exception of about four years, served continuously in that corps and the Weather Bureau until his death. His duties in the Bureau were those of draftsman, for which he had been fitted by education in Germany. Mr. deGrain enjoyed the high respect both of his comrades in the Grand Army of the Republic, of which he had long been an active member, and of his associates in the Weather Bureau. He was buried in Arlington National Cemetery.—J. P. C.

FORECASTS AND WARNINGS.

By Prof. E. B. GARRIOTT, in charge of Forecast Division.

High barometric pressure prevailed over the eastern Atlantic during the first half of April. From the 16th to 19th a disturbance moved from Portugal northeastward over continental Europe. During the last decade of the month pressure was low over the British Isles, with reported minimum, 28.98 inches, at Sumburg Head, Scotland, on the 28th. In the vicinity of the Azores the barometer was high except on the 1st, 2d, and 12th, when slight depressions were shown in that region. Over the western Atlantic there were frequent fluctuations of the barometer until the 17th, after which the pressure continued low, with a minimum of 29.00 inches at Eastport, Me., on the 24th.

The first important storm of the month in the United States occupied middle and southern portions of the Rocky Mountain and Plateau regions from the 1st to 7th, crossed the lower Missouri Valley on the 8th, the Great Lakes on the 9th and 10th, and by the evening of the 10th had united on the southern New England coast with a secondary disturbance that had developed on that date over Virginia. During the 11th the storm center moved northeastward over the Canadian Maritime Provinces. This disturbance was attended by snow in the northern Plateau and northern Rocky Mountain districts, by rain from the Pacific coast over middle and southern portions of the Plateau and Rocky Mountain districts, and, in connection with low area III, by rain generally east of the Rocky Mountains. From southern California over western Arizona, southern Nevada, and southwestern Utah, and in areas from the Mississippi and lower Missouri valleys to the Atlantic coast the rainfall was heavy, and augmented flood stages in the lower Ohio and lower Mississippi rivers and tributaries. On the 10th and 11th high easterly shifting to northwesterly winds prevailed on the New England coast.

From the 10th to 15th a disturbance moved from California to the St. Lawrence Valley. On the 10th and 11th rain fell from the Pacific coast over the middle Rocky Mountain districts, and extended on the 12th over the Missouri and middle and upper Mississippi valleys, with snow in the northern Rocky Mountain districts. During the afternoon of the 12th severe local storms were reported in an area extending from

southern Kansas to northern Texas. During the 13th heavy rain and thunderstorms occurred in the lower Mississippi Valley and the rain area extended over the Ohio Valley and the upper Lake region. The rain area reached the Atlantic coast on the 14th and during the night of that date was heavy in the Middle Atlantic States.

In connection with a disturbance that moved from the British Northwest Possessions to the Maine coast from the 19th to 22d and two disturbances, secondary thereto, that appeared over the Middle Atlantic States and passed thence northeastward, rain fell in the Middle Atlantic and New England States and snow from the upper Ohio Valley over the mountains of Pennsylvania and the interior of New York and New England from the 21st to 23d, and gales prevailed along the middle Atlantic and New England coasts from the 22d to 24th. From the 22d to 24th rain fell in the Pacific coast States. From the 23d to 26th a disturbance moved from the British Northwest Possessions to Minnesota, attended on the 25th by showers and thunderstorms in the Northwestern States. From the 26th to 30th a disturbance advanced from the southeastern Rocky Mountain slope to the St. Lawrence Valley, attended on the 26th and 27th by snow and rain in Colorado, and on the 27th by thunderstorms in the lower Missouri Valley. On the night of the 26th severe local storms were reported at several points in Texas. From the 27th to the close of the month a disturbance moved from the north Pacific coast to western Kansas, attended by rain from the Pacific States to the Mississippi and Ohio valleys, and by snow at Flagstaff, Ariz.

On the morning of the 2d light frost occurred on the east Gulf and south Atlantic coasts, and on the 2d and 3d heavy frost was reported at Wilmington, N. C. From the 15th to 18th a frost-bearing cool wave advanced from the Missouri and upper Mississippi valleys to the middle Atlantic coast States, and heavy frost occurred in the mountains of Virginia and North Carolina on the 17th and 18th. On the 23d heavy frost was reported in the upper Mississippi and Ohio valleys, and on the 24th from the lower Lake region and upper Ohio Valley over the Middle Atlantic States and North Carolina,

with light frost as far south as Augusta, Ga. During the closing days of the month freezing temperature and snow occurred at Flagstaff, Ariz.

Warnings were issued well in advance of storms that threatened shipping on the seacoasts and Great Lakes, and ample and timely advices regarding frosts and freezing temperatures were distributed in sections where vegetation was subject to damage by cold.

The display of storm warnings on the Great Lakes was resumed for the season April 16, 1906.

BOSTON FORECAST DISTRICT.

The principal storm occurred on the 9th and 10th, when heavy precipitation occurred over a great part of New England. In Maine the precipitation fell as snow, which exceeded 6 inches in many sections of the State. Along the coast the storm was attended by easterly gales that caused considerable damage to shipping and to telegraph and telephone lines. Storm warnings are displayed in connection with this storm and also on the 14th and 24th. No gales occurred for which warnings were not displayed.—*J. W. Smith, District Forecaster.*

LOUISVILLE FORECAST DISTRICT.

Fine seasonable weather prevailed. Several thunderstorm periods were attended by moderate rains and more or less severe local storms. There were three warm periods and a like number of cool periods with frost. Special frost warnings issued on the mornings of the 16th and 23d were verified.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.

Warnings were issued to open ports on Lake Michigan in connection with storms that reached the upper Lake region on the 9th and 14th. On the morning of the 25th warnings were issued to Lake ports for a storm that occupied the middle Missouri Valley. This storm was attended by thunder-squalls on Lakes Michigan and Superior.—*H. J. Cox, Professor and District Forecaster.*

NEW ORLEANS FORECAST DISTRICT.

No storm or cold-wave warnings were issued or required. Frost warnings were issued on the 13th for Oklahoma and on the 14th for Arkansas and were verified over portions of the area covered by the warnings. No frost occurred without warning.—*I. M. Cline, District Forecaster.*

DENVER FORECAST DISTRICT.

Unsettled weather predominated. Storms were not severe in the plains region, but in the mountain districts, especially in Colorado, heavy falls of snow were common. Light frost was noted on a number of dates, but owing to the backwardness of vegetation little or no damage resulted. No special warnings were issued or needed.—*F. H. Brandenburg, District Forecaster.*

SAN FRANCISCO AND PORTLAND FORECAST DISTRICTS.

Rain occurred in southern California on the 4th, 5th, and 6th, and in Nevada on the 11th, and rain was general in California and Nevada on the 10th, 22d, 27th, and 28th. In the North Pacific States and Idaho the month was warm and dry, the mean temperature at Portland, Oreg., being the highest on record for that station. Frost occurred frequently during the month and timely warnings were issued in connection therewith. Storm warnings were ordered well in advance of a storm that appeared off the Washington coast on the morning of the 8th.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

At the close of the month of March, 1906, the Ohio and Mississippi rivers and their principal tributaries were rising rapidly, and by the second day of April a moderate flood was in progress in the Ohio River below the Big Sandy, the crest passing Cairo on the 9th. The stages from Cincinnati to Cairo were only slightly above the flood lines, except at Evansville

and Mount Vernon, Ind., where the water reached a height of a little over 41 feet on the 6th and 7th, about six feet above the flood stage. Along the Wabash and White rivers the flood was quite severe, with a stage at Mount Carmel, Ill., on the Wabash River, of 23.6 feet, 8.6 feet above the flood stage. A large area of bottom lands was overflowed, and in a few low-land sections the people were compelled to temporarily abandon their homes. The damage done was comparatively little, as the floods occurred sufficiently early to allow the bottoms to dry out fairly well before the full inauguration of the season of spring plowing. There was some damage done to growing wheat along the Wabash River, but its exact extent has not been ascertained.

The preliminary warnings for these floods were issued on March 28, and specific ones regularly thereafter until the waters began to recede.

The lower Mississippi flood also set in early, and the dates of reaching the flood stages at the various stations were as follows:

Station.	Flood stage.	Date.	Maximum stage.	Date.
New Madrid, Mo.	34	April 2	37.0	April 9-12
Luxora, Ark.	33	31.3	April 14-15
Memphis, Tenn.	33	April 6	37.1	April 16
Helena, Ark.	42	April 8	47.0	April 18-19
Arkansas City, Ark.	42	April 5	50.0	April 22
Greenville, Miss.	42	April 14	44.9	April 23-24
Vicksburg, Miss.	45	April 17	47.2	April 26
Natchez, Miss.	46	April 24	46.7	April 29-30
Baton Rouge, La.	35	May 1
New Orleans, La.	16	April 20

At the end of the month the river was falling from Natchez northward, but was still rising slowly below.

The issue of flood warnings began over the Memphis district on March 31, and they were gradually extended southward at the proper times. The warnings were verified to almost absolute exactness, and, so far as has been ascertained, no serious damage was caused, nor was there any irreparable delay in planting. Many people were, of course, subjected to considerable expense and inconvenience, but such experiences are in a measure expected almost annually. The following report on the flood in the Memphis district was prepared by Mr. S. C. Emery, the official in charge of the local office of the Weather Bureau at Memphis, Tenn. The remarks of Mr. Emery as to the effects of recent levee construction, and his deductions from the changed gage relations between Cairo and Helena, are especially interesting and instructive.

The first important rise of the season had its beginning about March 1, and was caused by a series of heavy rains over the Missouri watershed, supplemented by a protracted period of local rains. After reaching nearly a bank-full stage about the middle of March, there occurred a slight decline, which was suddenly checked on March 24 by a sharp rise. This was caused by a Texas rainstorm that passed over the central valleys about that time, causing flood stages in many of the upper tributaries. These flood waters came mainly from the upper Mississippi, Ohio, and Cumberland rivers, and coming, as they did, into the lower stream with its already well-filled banks, at once gave promise of very high water throughout this district. Accordingly on March 31 warning messages and bulletins were extensively distributed over the threatened area; the inhabitants of the lowlands of Tennessee and Arkansas were notified that flood stages would soon prevail throughout the district, and that the river would be out of its banks in about seven days. Two days later a second warning bulletin was issued, in which the people were advised to prepare for stages as high as 38 feet at New Madrid, 37 feet at Memphis, and 47 feet at Helena. Considering the already swollen condition of the river, the rise was remarkably rapid, the daily increase ranging from two feet to about one-half foot from the beginning of the rise, on March 24, until the arrival of the flood crest, on April 14. On the latter date the river became practically stationary at Memphis, although the actual maximum occurred at noon of the 16th, when the gage marked 37.1 feet. The highest stage reached at New Madrid was 37 feet on April 9, and that at Helena, 47 feet on the 18th.

The river was above the danger line as follows: New Madrid from April 2 to 19, 18 days; at Memphis from April 6 to 24, 19 days; and at Helena from April 7 to 28, 21 days.